REMARKS

By this Amendment, Claims 1-10 and 12-18 are canceled, Claim 11 is amended and new Claims 19-20 are added leaving Claims 11 and 19-20 pending for the Examiner's review and consideration. Reconsideration of the Official Action dated May 18, 2005 is respectfully requested.

Claims 1-6, 8, 10 and 12-17 were rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as allegedly obvious over U.S. Patent No. 6,794,690 to Uemura. Claims 7 and 11 were rejected under 35 U.S.C. § 103(a) as obvious in view of Uemura. Uemura discloses thermally processing a p-type electrode in a temperature range of from 400 to 700°C. In view of the temperature range disclosed by Uemura, the Official Action alleges that it would have been obvious to thermally process a p-type electrode in a temperature range of 80 to 350°C. Applicants respectfully disagree. Finally, Claims 9 and 18 were rejected under 35 U.S.C. § 103(a) as obvious in view of Uemura. The Official Action alleges that it would have been obvious to form an active layer from a material having the formula $In_xAl_yGa_{1-x-y}N$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, and $x+y \leq 1$). By this amendment, Claims 1-10 and 12-18 are canceled. Accordingly, Applicants submit that the rejection of Claims 1-10 and 12-18 is moot.

Applicants' claimed invention is directed to a method for manufacturing a light emitting diode. In particular, and reciting the elements of independent Claim 11, as amended, the exemplary method includes (a) sequentially forming an n-type semiconductor layer, an active layer, and a p-type semiconductor layer on a substrate; and (b) forming a p-type electrode on the p-type semiconductor layer, said p-type electrode being in electrical contact with the p-type semiconductor layer;

wherein step (b) includes sequentially forming a first metallic layer on the p-type semiconductor layer and a second metallic layer on the first metallic layer, said first metallic layer making ohmic contact with the p-type semiconductor layer, and thermally-processing the first and second metallic layers in a non-oxygen atmosphere at a temperature between 80°C and 260°C inclusive and stabilizing the first and second metallic layers, wherein the first metallic layer comprises a metal selected from the group consisting of palladium (Pd) and platinum (Pt), and the second metallic layer is silver (Ag) and is adapted to reflect light.

As recited at page 6, lines 25-28, page 7, lines 9-13 and in Figure 3 of the specification, the operational voltage of an exemplary light emitting diode is 3.5V or less when palladium and silver (or platinum and silver) are used to form the first and second metallic layers, respectively, of a p-type electrode and the thermal processing temperature of the electrode is within the range of 80 to 260°C. As illustrated in Figure 3, if the thermal processing temperature exceeds 280°C the operational voltage increases dramatically.

Applicants believe that when the thermal processing temperature exceeds 280°C, silver readily diffuses from the second metallic layer through the first metallic layer and comes into contact with the p-type semiconductor layer. Contact between the silver and the p-type semiconductor layer can degrade the ohmic contact between the first metallic layer and the p-type semiconductor layer, which can result in an increase in the operational voltage. Accordingly, Applicants have discovered that thermal processing of the first and second metallic layers in a non-oxygen atmosphere at a temperature between 80°C and 260°C is critical in order to minimize the effect of silver diffusion on the ohmic contact between the first metallic layer and

the p-type semiconductor layer. See *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

Uemura discloses a light emitting diode comprising a first metal layer containing silver formed on a p-type semiconductor layer (see column 3, lines 52-54). A second metal layer, which does not contain silver, is formed over the first metal layer (see column 5, line 39-column 6, line 34). Uemura further discloses that the first metal layer can be formed as a laminate of a plurality of layers comprising a first adhesive layer of nickel, cobalt, gold, palladium or platinum that can enhance the adhesive property between the p-type semiconductor layer and the silver-based layer (see column 4, lines 15-27). In order to reduce the interfacial resistance between the first metal layer and the p-type semiconductor layer, heating is performed in a range of from 400°C to 700°C before the second metal layer is formed (see column 7, lines 47-61). Uemura discloses that if heating at a high temperature is performed after the formation of the second metal layer, silver is diffused to the second metal layer and may migrate to the surface of the second electrode layer (see column 7, lines 62-67).

Applicants submit that the disclosure of Uemura neither anticipates nor renders obvious the subject matter of Applicants' claimed invention. Applicants submit that Uemura is directed to control of the migration of silver to the second electrode layer surface and not to the migration of silver to the interface between the first metal layer and the p-type semiconductor layer. Uemura discloses that migration of silver to the second electrode layer surface can be suppressed by heating before the second metal layer is formed. However, Uemura does not disclose heating the first and second metallic layers at a temperature between 80°C

and 260°C, as recited in Claim 11. In each of the examples of Uemura, heating is carried out at a temperature in the range of from 400°C to 700°C. In embodiment 2 of Uemura, for example, the first metal layer 20a of Uemura comprises a laminate of a first layer 21 of cobalt, a second layer 22 of gold, a third layer 23 of silver, a fourth layer 24 of gold and a fifth layer 25 of nickel. The first metal layer is heated at 600°C.

Further, Applicants submit that the Official Action has set forth no tenable basis as to why one having ordinary skill in the art would have been motivated by Uemura to heat at a temperature between 80°C and 260°C. As disclosed by Uemura at column 7, line 67-column 8, line 2, when heating is performed before the formation of the second metal layer, diffusion of silver can be prevented. Thus, Applicants submit that Uemura provides no motivation to heat the first metal layer at a temperature less than the 400°C disclosed by Uemura because the problem of silver migration into the second metal layer can be addressed simply by heating the first metal layer before the formation of the second metal layer. Indeed, in the second embodiment of Uemura, a structure comprising a silver-containing layer (corresponding to Applicants' second metallic layer) formed on an adhesion layer (corresponding to Applicants' first metallic layer) is heated at 600°C, which is more than twice the maximum temperature of 260°C recited in Claim 11.

Applicants have discovered that a marked improvement (i.e., reduction) in the operational voltage can be achieved by heating the first and second metallic layers at a temperature between 80°C and 260°C, as compared with heating the first and second metallic layers at a higher temperature as recited by Uemura. As shown in Figure 3, the operational voltage of an exemplary light emitting diode is less than

3.5V when the thermal processing temperature used to heat the first and second metallic layers is between 80°C and 260°C.

In light of the foregoing, Applicants respectfully request reconsideration and allowance of the above captioned application. Should any residual issues exist, the Examiner is invited to contact the undersigned at the number listed below.

Respectfully submitted,

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